

REMARKS

I. Status of the Claims

Claims 1 through 69 remain pending. No claims have been amended herein.

II. Claim Rejections Under 35 U.S.C. §103(a)

Reconsideration is requested of the rejection of claims 1-5, 9-12, 17-36, 40-43, and 48-69 as being obvious over Seitz et al. (U.S. 5,925,595) alone or in view of Asrar et al. (WO 2008/082901).

A. The Claimed Invention and the Prior Art

Claim 1 is directed to a pesticidal material comprising a substantially water-immiscible core material, the core material comprising a pesticide and being encapsulated in a shell having a predetermined permeability with respect to the core material, ... wherein the shell of the microcapsule is formed by an interfacial polymerization of a polyisocyanate with other monomers in an encapsulation shell-forming polymerization system, said other monomers comprising a principal amine and an auxiliary amine, Independent claims 24, 25, 32, 55, and 56 contain similar requirements.

The pesticidal material defined by claims 1, 24, 25, and 32 and the agricultural formulation of claims 55 and 56 thus requires the shell wall of the microcapsule be prepared by reacting a polyisocyanate and a blend of a principal amine and an auxiliary amine. Seitz et al. neither disclose nor would they have made it obvious to the ordinarily skilled person to prepare a pesticidal material meeting all of the limitations of claims 1, 24, 25, 32, 55, and 56.

Seitz et al. disclose a method of producing a microencapsulated pesticide. The pesticide is encapsulated in a polyurea shell wall prepared from three components: (1) a trifunctional adduct of a linear aliphatic isocyanate, (2) an aliphatic linear diisocyanate, and (3) a polyamine. The rate of release of core material through the spherical shell wall is stated to be directly proportional to the relative amounts of the trifunctional adduct of a linear aliphatic isocyanate and the aliphatic linear diisocyanate.

Seitz et al.'s disclosure of amines useful for reacting with the trifunctional adduct of a linear aliphatic isocyanate and the aliphatic linear diisocyanate is found at Col. 8, lines 1-8. They are stated to be "expected to function adequately." The polyamine is added to the composition in order to react with the isocyanate components to form the desired polyurea. The amine is added to avoid the undesired hydrolysis of the isocyanate. Seitz et al. do not disclose or suggest any formulations containing more than one polyamine.

B. Rejections Over Seitz et al. alone

In rejecting claim 1 and the other independent claims over Seitz et al., the Office states on page 5 of the Office Action, "It is generally *prima facie* obvious to combine prior art elements according to known methods to yield predictable results. See MPEP 2141 III(A)." MPEP §2143 Part A. sets out the requirements the Office must show to support *prima facie* obviousness based on the Office's cited rationale:

A. Combining Prior Art Elements According to Known Methods To Yield Predictable Results

To reject a claim based on this rationale, Office personnel must resolve the *Graham* factual inquiries. Then, Office personnel must articulate the following:

(1) a finding that **the prior art included each element claimed**, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in a single prior art reference;

(2) a finding that one of ordinary skill in the art could have combined the elements as claimed by known methods, and that in combination, each element merely performs the same function as it does separately;

(3) a finding that one of ordinary skill in the art **would have recognized** that the results of the combination **were predictable**; and

(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

If these conditions are not met, the Office's rationale is not sufficient to support *prima facie* obviousness, and the rejection should be withdrawn. The cited Seitz et al. reference fails to meet the first condition required by MPEP §2143 Part A. since the Seitz et al. reference does not include "each element claimed," in particular, the use of both a principal amine and an auxiliary amine to prepare the microcapsule shell wall. More importantly, with regard to the third condition, the results achieved via the use of a blend of amines, i.e., a principal amine and an auxiliary amine as required by claim 1, were not predictable in that the blend of amines yields **unexpectedly** superior results with respect to the control and reliability of the half-lives of the microcapsules prepared thereby that could **not possibly have been predicted** by the ordinarily skilled person having the benefit of Seitz et al.'s disclosure.

With regard to unexpected results, MPEP 716.02(a) Part II.
states:

**II. SUPERIORITY OF A PROPERTY SHARED WITH THE PRIOR ART IS
EVIDENCE OF NONOBVIOUSNESS**

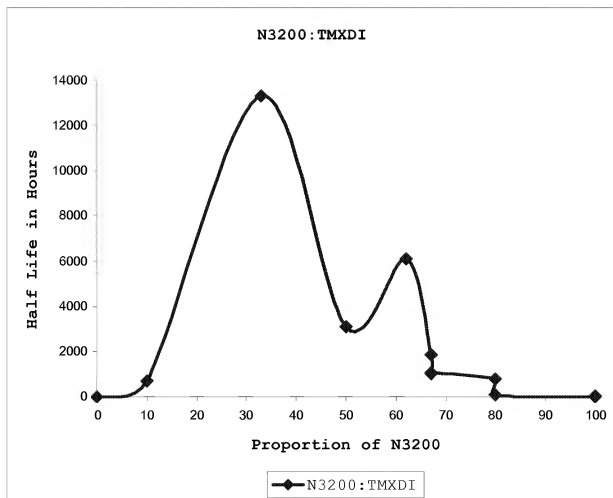
Evidence of *unobvious* or *unexpected* advantageous properties, *such as superiority in a property the claimed compound shares with the prior art*, can rebut *prima facie* obviousness. "Evidence that a compound is *unexpectedly superior* in one of a spectrum of common properties . . . can be enough *to rebut a prima facie case* of obviousness." No set number of examples of superiority is required. *In re Chupp*, 816 F.2d 643, 646, 2 USPQ2d 1437, 1439 (Fed. Cir. 1987)

Herein, as shown by the data and set forth in the remarks below, preparation of microcapsules using a blend of a principal amine and an auxiliary amine unexpectedly resulted in a degree of reliability and control of half life of release that could not possibly have been predicted from Seitz et al.'s disclosures and examples. Given that the ordinarily skilled person could not have predicted such superiority of control and reliability of half life of release from Seitz et al.'s disclosure, *prima facie* obviousness cannot be found herein for failure to satisfy all of the conditions -- in particular, the critical third condition -- required by MPEP §2143 Part A.

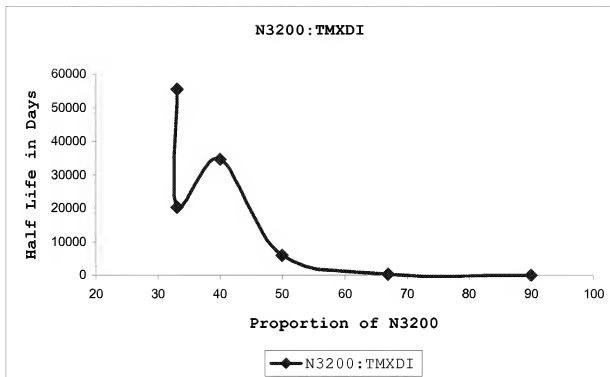
Seitz et al. prepared microcapsules using a blend of the polyisocyanates Desmodur N3200 ("N3200" in Tables 1 and 2) and meta-tetramethylxylylene ("TMXDI" in Tables 1 and 2) in varying proportions. The microcapsules of Examples 1-6 and 13-18 were prepared using triethylene tetraamine ("TETA" in Table 1). The following table shows the relative proportions of polyisocyanate and the half lives of the resultant microcapsules prepared according to the methods described in these Examples:

| Example | N3200 | TMXDI | Half Life in Hours |
|---------|-------|-------|--------------------|
| 5 | 100 | 0 | 26 |
| 15 | 100 | 0 | 4 |
| 14 | 80 | 20 | 72 |
| 17 | 80 | 20 | 816 |
| 1 | 67 | 33 | 1080 |
| 13 | 67 | 33 | 1008 |
| 16 | 67 | 33 | 1848 |
| 18 | 62 | 38 | 6096 |
| 2 | 50 | 50 | 3120 |
| 3 | 33 | 67 | 13320 |
| 4 | 10 | 90 | 696 |
| 6 | 0 | 100 | 20 |

Below is a graphical depiction of these half-lives (in hours) as a function of the proportion of N3200 polyisocyanate:



The microcapsules of Seitz et al.'s Examples 7-12 were prepared using the same blend of polyisocyanates with triethylene tetraamine ("DETA" in Table 1) instead of TETA. Below is a graphical depiction of the half-lives (in days) as a function of the proportion of N3200 polyisocyanate:



It is notable that, in each graph of the Seitz et al. data, the relationship between proportions of isocyanate monomers and half life is erratic, volatile, and unreliable. At most relative proportions, utility of the Seitz formulation for controlled release is limited because the half life is either much too long or much too short. Discontinuities in the graphs illustrate the volatility in shifting between too long and too short.

In contrast to the graphs prepared from Seitz et al. data, the half life release values for the formulations of the present invention are smoothly and reliably correlated to the relative proportions of principal and auxiliary amines, and the half

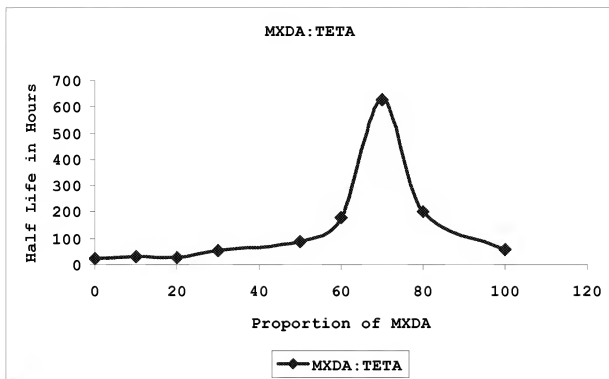
lives fall in a useful range over wide ranges of relative proportions.¹

In the present application, the microcapsules of Examples 3A through 3I were prepared using Demodur N3200 polyisocyanate. The amine component comprised a blend of triethylene tetraamine ("TETA") and meta-xylene diamine ("MXDA"). The following table shows the relative proportions of the amines and the half lives of the resultant microcapsules prepared according to the methods described in these Examples:

| Example | MXDA | TETA | Half Life in Hours |
|---------|------|------|--------------------|
| 3I | 100 | 0 | 57.84 |
| 3F | 80 | 20 | 199.92 |
| 3E | 70 | 30 | 626.4 |
| 3G | 60 | 40 | 178.08 |
| 3D | 50 | 50 | 88.8 |
| 3C | 30 | 70 | 53.76 |
| 3B | 20 | 80 | 25.92 |
| 3A | 10 | 90 | 30 |
| 3H | 0 | 100 | 24 |

¹ As explained below, the difference in volatility is not fully reflected by a comparison of the shapes of the curves as separately depicted. To properly understand the differences, it is necessary to consider the scale of the ordinate, which is only 0 to 700 hours on the MXDA:TETA plot of data from the instant application, but 0 to 14,000 hours on one of the N3200:MTXDI plots based on the Seitz et al. data, and 0 to 60,000 hours on the other.

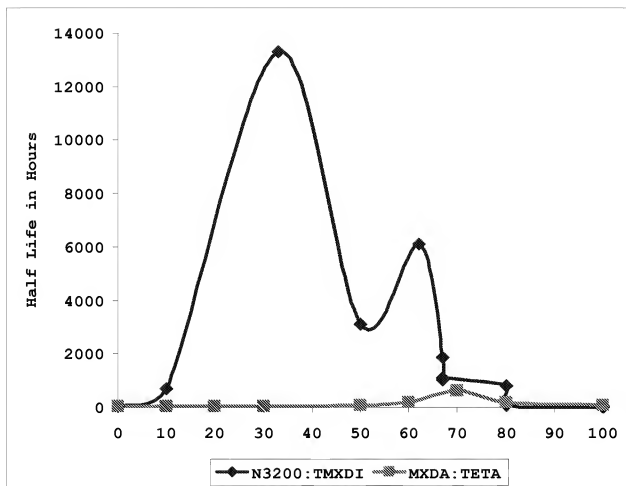
Below is a graphical depiction of the half-lives (in hours) as a function of the proportion of MXDA amine:

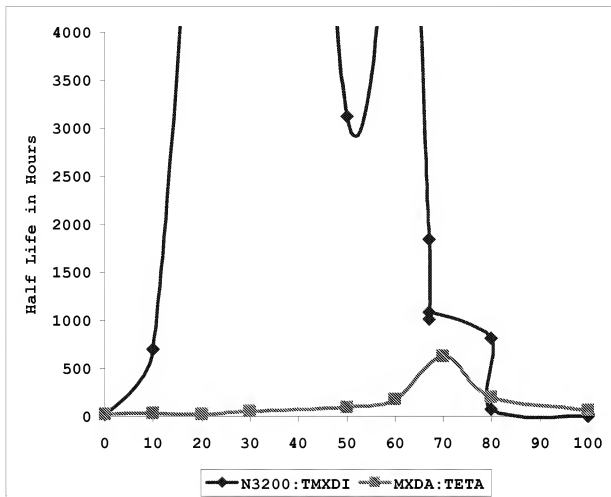


In contrast to the graphs prepared from the Seitz et al. data, the half life of release appears to be strongly correlated to and thus predictable from the relative proportions of amine.

A showing of unexpected results generally requires a direct comparison between the prior art that is closest to the claimed invention, for example, a showing that the differences between the prior art and the invention pertain to a novel feature of the invention. See MPEP §716.02(e) and *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Herein, the Seitz et al. Examples 1-6 and 13-18 differed from the present application's Examples 3A through 3I with respect to the substitution of the TMXDI polyisocyanate from Seitz et al.'s polyisocyanate blend with MXDA amine to thereby yield the present application's polyamine blend, which is the novel feature of the present invention. An overlay of the data, which allows for direct

comparison of the half-lives of release, from the prior art
Seitz et al. examples and the examples of the present
application is presented in the following two graphs:





In the above two graphs, the curve with the diamonds (--◆--) at each data point was derived from the Examples of the Seitz et al. patent while the curve with the squares (--■--) at each data point was derived from the Examples of the present application.

The data are directly comparable since the difference between the half lives result from the substitution of a polyisocyanate with a polyamine, which is the novel feature of the claims of present invention over the Seitz et al. reference. A comparison of these data yields the following conclusions, among others, regarding the exceedingly superior control of half life of release obtained by using a blend of amines over a blend of polyisocyanates:

First, the half lives of release of the Seitz et al. examples vary widely with relatively minor changes in the relative proportions of the polyisocyanates. Compare this to the half lives of release of the present application's examples, which show far less variability with each change in the relative proportions of polyamines. Nothing in Seitz et al.'s disclosure would have given the ordinarily skilled person the ability to predict that the half life of release could be so reliably controlled by varying the relative proportion of the amines in a polyamine blend.

Second, many of the half lives of release of the Seitz et al. examples are excessively long and thereby result in commercially impractical pesticidal materials. Some of the examples had measured half lives on the order of years (e.g., 16 years, 56 years, and even 95 years for Seitz et al.'s examples 8-10).² The data show that only minor variations in the relative ratio of polyisocyanates can alter the release rate characteristics widely from short half lives to exceedingly long half lives. Only a select window of polyisocyanate proportions yields microcapsule release rates of commercially acceptable durations using Seitz et al.'s method. In the present application, the entire range of polyamine blends yield commercially useful microcapsule release rates. For example, over the entire range of relative proportions of amines, the half life varies from about 1 day to about 26 days. Depending upon soil conditions, climate, the crop, the types of weeds that may be present, etc., a commercial use may be found for each and

² While some of these half-lives were extrapolated out to very long durations and thus may involve some experimental or theoretical error in their measurement and calculation, particularly since it is impossible to measure a half life of 95 years in a practical manner, nevertheless, it is safe to conclude that the half-lives of certain of the Seitz et al. microcapsules are significantly longer than a half life that is commercially useful.

every example of the inventive pesticidal material. This contrasts sharply with Seitz et al., whose examples show only a few of the microcapsules (e.g., some of the microcapsules having less than 10% N3200 or greater than 80% N3200) have half lives of comparable duration, and the extreme sensitivity of half life to small changes in proportions makes quality control difficult, if not impossible. Nothing in Seitz et al.'s disclosure would have given the ordinarily skilled person the ability to predict that the entire range of relative proportions of the amines in a polyamine blend yield commercially viable pesticidal materials while only select, narrow windows of proportions of isocyanates result in commercially viable controlled release materials using the Seitz et al. method.

Finally, the Seitz et al. data show a distinct absence of reproducibility. The microcapsules of Seitz et al.'s Examples 14 and 17 were prepared using the following components and masses:

| Example 14 | | Example 17 | |
|------------------------------|------------------|------------------------------|--------------------|
| N3200 | 90.36 g | N3200 | 90.36 g |
| TMXDI | 15.07 g | TMXDI | 15.07 g |
| Ratio N3200:TMXDI | 80:20 | Ratio N3200:TMXDI | 80:20 |
| TETA | 22.57 g | TETA | 22.58 g |
| Mean Particle Size | 3 micrometers | Mean Particle Size | 2.7 micrometers |
| Acetochlor:Furizole Ratio | 30:1 | Acetochlor:Furizole Ratio | 30:1 |
| Wall:Core Ratio | 8% | Wall:Core Ratio | 8% |
| Half Life | 72 hours | Half Life | 816 hours |

Despite the essentially identical components and methods used to prepare the microcapsules of Examples 14 and 17, the half life differed by a factor of over 10. The half life of the microcapsules of Example 14 was about 72 hours, while the half life of the microcapsules of Example 17 was about 816 hours.

This is a substantial difference in half life resulting from what appears to be a nearly identical composition. Lack of reproducibility of the Seitz et al. pesticidal material is further evidenced by the above data and graphs. In beneficial contrast, the pesticidal material of the present invention displays a remarkably predictable change in half life with variation of the relative proportions of the amines in the polyamine blend. Nothing in Seitz et al.'s disclosure would have given the ordinarily skilled person the ability to predict that employing a polyamine blend to prepare the microcapsule shell wall results in predictable variations in half life of release given the very unpredictable and unreproducible nature of the pesticidal materials prepared using the Seitz et al. method.

In view of the above data obtained from the Seitz et al. patent and the present application, it is apparent that the novel feature of using a blend of a principal amine and an auxiliary amine resulted in unexpectedly superior control and reliability of the half life of release that would have been unpredictable to the ordinarily skilled person having the benefit of the Seitz et al. patent, which shows volatility, irreproducibility, excessively long half lives, and other critical faults. In view thereof, applicants respectfully submit that the Office cannot satisfy all of the conditions of MPEP §2143 Part A. and that the *prima facie* case of obviousness has been effectively rebutted.

The Office has also stated "it would be obvious to one skilled in the art to also try varying the other component of the polyurea shell wall (i.e., the polyamine) by using more than one amine in specified ratios in order to improve the

permeability of the shell wall." MPEP §2143 Part E. states that obviousness based on an "Obvious to try" rationale requires:

(1) a finding that at the time of the invention, there had been a recognized problem or need in the art, which may include a design need or market pressure to solve a problem;

(2) a finding that there had been a finite number of identified, ***predictable*** potential solutions to the recognized need or problem;

(3) a finding that one of ordinary skill in the art could have pursued the known potential solutions with a reasonable expectation of success; and ...

As stated in MPEP §2143 Part E.: "If ***any of these findings cannot be made***, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art." In the present case, obviousness cannot be predicated upon "obvious to try" since the prior art did not recognize a ***finite*** number of ***predictable*** solutions to the problem of preparing controlled release microcapsules nor provide a reasonable expectation that the solutions could be achieved by employing a blend of a principal amine and an auxiliary amine. That is, prior to applicants' invention, the ordinarily skilled person would not have been able to predict that using a principal amine and an auxiliary amine would have led to microcapsules having predictable, reliably reproducible half lives of release as shown by the above data, which sharply contrasts with the microcapsules prepared by employing a blend of polyisocyanates, which, among other faults, exhibited poor reproducibility and, in many cases, impractically long half lives.

Seitz contains no relevant disclosure of any combination of amines, but rather dismisses this topic by requiring no more

than "adequately functioning amines," and giving a modest list. Given the erratic performance obtained from combinations of isocyanates, which are the only subject of the Seitz invention, Seitz offers no expectation of any better result from mixing amines rather than isocyanates. From Seitz et al.'s bare reference to "adequately functioning amines," the skilled person in the art could not have predicted that combinations of amines would achieve the reliable, predictable release that evaded Seitz et al. themselves. As explained above, the Seitz et al. half life itself can vary from extremes of nearly instantaneous release in the case of rupture to nearly infinite, if, for example, the core material is wholly insoluble in the shell wall. The effect of using a blend of a principal amine and an auxiliary amine on either of these requirements is not predictable from Seitz et al.'s disclosure.

Applicants' inventive pesticidal material which comprises a shell wall formed by a polymerization reaction between a polyisocyanate, a principal amine, and an auxiliary amine surrounding a core material is predicated on the discovery of several previously undisclosed factors that may be manipulated by employing a principal amine and an auxiliary amine to affect the mechanism of release and the release rate of the core material through the shell wall. According to the U.S. Supreme Court's decision in *Eibel Process Co. v. Minnesota & Ontario Paper Co.*, 261 U.S. 45 (1923), the discovery of the source of a previously unknown problem and the provision of a novel solution may be unobvious.

The previously undisclosed factors themselves are described in paragraph [0073] and include: "(1) the solubility of the core in the shell wall, (2) the resistance of the polymer to movement of core material molecules within [the wall] due to the

chemical composition of the shell wall, and (3) the interaction between these factors." Prior to applicants' discovery and disclosure, no prior art reference currently of record disclosed the manipulation of the three factors described in paragraph [0073] in preparing the shell wall polymers in order to increase or decrease the molecular diffusivity of core materials through the shell wall; *a fortiori*, no reference disclosed such manipulation through the use of a principal amine and an auxiliary amine.

Based on the art of record, the first factor, the solubility of the core material in the shell wall was not, prior to applicants' discovery and disclosure, predictable merely by examination of proposed shell wall materials, and it was certainly not known how employing a principal amine and an auxiliary amine to prepare the shell wall would affect the overall solubility of the core material in the shell wall. Rather, applicants discovered and disclosed that the solubility of the core material in the shell wall may be determined by, for example, calculating the Hildebrand solubility parameter and correlating that parameter to the relative ratios of a principal amine and an auxiliary amine used to prepare the shell wall polymer, as discussed in applicants' specification at paragraphs [0077] to [0081], and in particular, paragraph [0079].

The cited Seitz et al. patent does not discuss the solubility of the core in the shell wall, disclose how it may be manipulated, or enable the ordinarily skilled person to correlate shell wall solubility with the shell wall components, much less to correlate the solubility to a blend of amines. Seitz et al. is further silent regarding the Hildebrand solubility parameter and its usefulness for manipulating polymer

composition to affect the solubility of core materials in the polymer shell wall.

With regard to the second factor, as stated by applicants at paragraph [0082] of their published application, "that while the core is selected to be soluble in the shell wall, this may not ensure a semi-permeable microcapsule...the second factor above...may have a greater effect on release rates than the ability of the core material to swell the shell wall." As further described by applicants from paragraphs [0082] to [0085] of their published application, polymer shell wall resistance to movement of core material molecules within the wall may be manipulated by the choice of and relative ratios of principal amine and auxiliary amine. For example, applicants describe blending amines comprising alkyl or alkyl ether linkages which provide flexible amorphous segments and amines comprising aromatic or cyclic hydrocarbon rings which provide rigid regions to thereby affect freedom of movement of core material within the shell wall. Seitz et al. do not correlate shell wall resistance to a blend of a principal amine and an auxiliary amine, and therefore would not have enabled the skilled person to predict how the resistance of the shell wall may be affected by using a blend of amines in preparing the polymers thereof.

Overall, therefore, the ordinarily skilled person with the knowledge of the art prior to applicants' disclosure lacked the ability to recognize that release rate is affected by the solubility of core material in the shell wall or predict how solubility of the core material and the resistance of the shell wall to core material mobility therein may be affected through the use of a blend of a principal amine and an auxiliary amine in preparing the shell wall polymers, or how either of these factors, or the combination thereof, would affect release rates.

Applicants, through their discovery, have provided and disclosed methods providing the predictability that was lacking in the art. Based on the principles explained in applicants' specification and the numerous specific examples provided, applicants enabled those skilled in the art to use a wide variety of amines to tailor the encapsulated pesticide to a target release rate anywhere in the claimed 5-100 day half life range.

Applicants discovered that the molecular diffusivity of the shell wall may be manipulated to control the rate of molecular diffusion of core material, to either increase or decrease the rate at which core material diffuses through the wall, through the use of a principal amine and an auxiliary amine. Applicants have further shown how the principal amine and an auxiliary amine affect the solubility of core material in the polymer shell wall and how the principal amine and an auxiliary amine affect the resistance of the polymer shell wall to core material mobility therein. Through their inventive insight, they discovered and disclosed a method for encapsulating a pesticide in a shell wall prepared from a blend of amines in which the half life is within the range of 5 to 100 days.

The disclosure of the Seitz et al. patent is wholly silent regarding core material solubility in the shell wall, shell wall resistance, and, importantly, how these factors are affected by employing a principal amine and an auxiliary amine in preparing the polymer shell wall. Thus, Seitz et al. did not disclose the conditions necessary for and would not have enabled the ordinarily skilled person to predict that using a blend of amines results in microcapsules having reproducible, reliably controllable half lives of release.

Applicants respectfully submit that the Office has improperly applied hindsight to read applicants' own discovery into the very limited disclosure of Seitz et al. and thus improperly concluded that the Seitz et al. disclosure provided the ordinarily skilled person with more knowledge than is fairly conveyed by Seitz et al.'s limited disclosure of amines. It is important to note that Seitz et al. disclose specific amines mostly because these are necessary components to react with isocyanates to form polyureas. Seitz et al. would not have enabled the preparation of polyureas at all without disclosing at least a few adequately functioning amine species at the top of Col. 8. Therefore, the ordinarily skilled person would not have read Seitz et al.'s amine disclosure as providing any reason to experiment with the combinations of different amines or their relative ratios to prepare the shell wall. Rather, the ordinarily skilled person would have read Seitz et al.'s amine disclosure as merely a necessary component in the synthesis of polyureas.

In short, Seitz et al. would not have enabled the ordinarily skilled person to predict that employing a blend of amines in various ratios could be used to prepare a pesticidal material having all of the features of claim 1. In view thereof, applicants respectfully submit that the disclosure of Seitz et al. would not have rendered claim 1 obvious, and applicants request that the rejection be withdrawn.

C. Rejection Over Seitz et al. in combination with Asrar et al.

The Office has also cited Seitz et al. in combination with Asrar et al., which discloses using two or more polyamines in forming the polyurea shell wall. The subject matter of the Asrar et al. reference is **not prior art** against the claims since

it is the work of the inventors of the present application and is thus not "by others" as required by 35 U.S.C. §102(a), and further, the Asrar et al. publication is not a time bar to patentability, i.e., it was not published at least one year prior to the effective filing date of the present application. See *In re Debaun*, 687 F.2d 459, 214 USPQ 933 (CCPA 1982). The meaning of "by others" means the work is done by any entity that differs from the inventive entity.

The four inventors of the present application submitted Declarations which accompanied Amendment A, filed with the Office on August 15, 2008. In these Declarations, each of the four inventors explicitly pointed out the exact disclosures that represented the work of the present inventive entity, i.e., Michael Seitz, Ronald Brinker, Jawed Asrar, and Yiwei Ding: Col. 24, lines 34 to Col. 27, line 65 of U.S. App. Ser. No. 10/115,765 (U.S. Pat. No. 6,992,047) and the microcapsule preparation methods of Examples 1 through 9. The disclosures on pages 43-46 of WO 2002/082901 relied upon by the Office in the present Final Office Action is identical to the disclosure unequivocally declared to be the work of the present inventive entity in the Asrar et al. U.S. 6,992,047 patent. The disclosure relied upon by the Office is thus not "by others" and thus cannot be prior art under 35 U.S.C. §102(a). In view thereof, all rejections that depend upon WO 2002/082901 are improper and should be withdrawn.

U.S. App. Ser. No. 10/115,765, which matured into U.S. Pat. No. 6,992,047 (all rejections based thereon were withdrawn in view of the inventor Declarations) and PCT/US02/10551, which published as WO 2002/082901 (the presently cited Asrar et al. reference), both claim priority to the same provisional application, U.S. Prov. App. Ser. No. 60/283,053. U.S. App.

Ser. No. 10/115,765 was filed April 3, 2002. PCT/US02/10551 was filed the next day. No changes were made to the specification between the two applications.

The following table displays unequivocally the exact correspondence (i.e., identical nature) of the disclosures of U.S. App. Ser. No. 10/115,765 (U.S. Pat. No. 6,992,047) and PCT/US02/10551 (WO 2002/082901):

| Disclosure representing the work of the inventive entity as set forth in the Declarations | Exactly Corresponding Citations in U.S. 6,992,047 and WO 2002/082901 |
|--|--|
| After the liquid composition that contains the agricultural actives is formed by using a non-aromatic solvent, or by using a melting point depressant, as described above, the composition is dispersed into small droplets. As used herein, the term "small droplets" means droplets having an average size of less than about 20 μ . Although any method may be used for dispersing the liquid composition into droplets, a commonly used method is to mix the organic liquid composition with a sufficient amount of an aqueous liquid to form a continuous phase, and to carry out the mixing at high rates of shear, such as may be applied by a high shear mixer or blender. | Col. 24, lines 34-45 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047) which is identical to Page 42, lines 14-23 in PCT/US02/10551 (published as WO 2002/082901) |
| When the small droplets of the liquid composition are formed, it has been found that the size of the droplets is a function of the rate of shear that is applied to the liquids during mixing, the viscosity of the two liquid phases, and the presence, type and amount of a surfactant or emulsifier material. | Col. 24, lines 46-51 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047) which is identical to Page 42, lines 24-28 in PCT/US02/10551, published as WO 2002/082901 |
| Surfactant or emulsifier materials that have been found to be useful in the present method include Lomar D (a | Col. 24, line 52-58 in U.S. App. Ser. No. 10/115,765 (issued as |

| | |
|---|--|
| <p>sodium salt of naphthalene sulfonic acid polymer, 81% (CAS No. 9084-06-4) sodium sulfate, 12.5%, and water, 6.5%; available from Cognis Corp.) and Sokolan CP 9 (sodium salt of maleic acid-olefin copolymer (CAS No. 127123-37-3) available from BASF, Parsippany, N.J.).</p> | <p>U.S. Pat. No. 6,992,047) which is identical to Page 42, line 29 to page 43, line 3 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>A preferred method of forming the shell that encloses the small liquid droplets is by an interfacial polymerization of monomers to form a polyurea shell around each droplet. A method for accomplishing this polymerization is to add one or more types of isocyanate monomers to the organic liquid composition. The organic liquid composition can then be dispersed in the aqueous phase. One or more polyamine monomers can then be added to the aqueous liquid in which the organic liquid composition is dispersed. The polyamines react with the isocyanates at the interfacial surface of the small droplets (the organic/aqueous interface) to form a solid polyurea shell that encloses the droplets.</p> | <p>Col. 24, line 59 to Col. 25, line 3 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047) which is identical to Page 43, lines 4-13 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>The isocyanates that are useful in the present method include polyisocyanates that can react with polyamines to form polyurea. One or more polyisocyanates can be used. Polyisocyanates that are useful in the present invention are discussed in Chemistry and Technology of Isocyanates, Ulrich, H., John Wiley & Sons, New York, (1996).</p> | <p>Col. 25, lines 4-9 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047) which is identical to Page 43, lines 14-18 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>Monomeric polyisocyanates include aliphatic, cycloaliphatic, araliphatic, aromatic, and heterocyclic polyisocyanates. Examples of such polyisocyanates include 1,12-dodecane diisocyanate cyclobutane-1,3-diisocyanate, cyclohexane-1,3-diisocyanate, 2,4- and/or 2,6-</p> | <p>Col. 25, lines 10-33 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047) which is identical to</p> |

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| <p>hexahydrotolulylene diisocyanate, 4,4',4''-triphenylmethane triisocyanate, tris-(4-isocyanatophenyl)-thiophosphate, Desmodur N3300 with a CA registration No: 104559-01-5, (1,6-diisocyanate homo-polymer, available from Bayer Corporation, Pittsburgh, Pa.),</p> <p>OCN--R--(O--CH₂CH₂)_x--R--NCO (polyethylene glycol),</p> <p>OCN--R--(OCH₂--CH--CH₃)_x--R--NCO (polypropylene glycol),</p> <p>OCN--R--(OCH₂CH₂CH₂CH₂)_x--R--NCO (polytetramethylene glycol),</p> <p>OCN--R--(OCH₂CH₂OCO--CH₂CH₂CH₂CH₂--CO)_x--R--NCO (polyethyleneadipate),</p> <p>OCN--R--(OCH₂CH₂CH₂CH₂OCO--CH₂CH₂ CH₂CH₂--CO)_x--R--NCO (polybutyleneadipate), and</p> <p>OCN--R--(OCH₂CH₂CH₂CH₂CH CH₂OCO)_x--R---NCO (polyhexamethylene-polycarbonate),</p> <p>where in each case, R can be CH₂ or CH₂CH₂ or alkyl.</p> | <p>Page 43, line 19 to page 44, line 2 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>It is preferred that the one or more polyisocyanates include at least one diisocyanate (having two reactive isocyanate groups per molecule) and/or at least one triisocyanate (having three reactive isocyanate groups per molecule).</p> | <p>Col. 25, lines 34-38 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 44, lines 3-6 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>Examples of useful diisocyanates can be found in the text by Ulrich, Id. at pp. 319, 330, 370, 374, and include (with commercial suppliers) HDI (Bayer), 1,5 Diisocyanatopentane, TMDI (Huls), C.sub.12DI (duPont), 1,6,11-</p> | <p>Col. 25, lines 39-65 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> |

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| <p>Undecanetriioscyanate (duPont), CHDI (Akzo), BDI (Eastman/Sun), HXDI (Takeda), IPDI (BASF, Bayer, Huls, Olin), IMCI, DDI-1410 (Henkel), XDI (Takeda), m-TMXDI (American Cyanamid), p-TMXDI (American Cyanamid), DEBI, HMDI (Bayer), $\text{OCN}(\text{CH}_2)_3\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{OCH}_2\text{CH}_2\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{OCH}(\text{CH}_3)\text{CH}_2\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{O}(\text{CH}_2)_3\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{O}(\text{CH}_2)_2\text{O}(\text{CH}_2)_2\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{OCH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{OCH}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{OCH}_2\text{C}(\text{Et})_2\text{CH}_2\text{O}(\text{CH}_2)_3\text{NCO}$,</p> <p>$\text{OCN}(\text{CH}_2)_3\text{OCH}_2\text{C}(\text{C}_3\text{H}_7)\text{CH}_2\text{O}(\text{CH}_2)_3\text{NCO}$,</p> $\begin{array}{c} \\ \text{CH}_3 \end{array}$ <p>$\text{OCN}(\text{CH}_2)_3\text{O}(\text{CH}_2)_4\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{O}(\text{CH}_2)_6\text{O}(\text{CH}_2)_3\text{NCO}$, $\text{OCN}(\text{CH}_2)_3\text{O}(\text{CH}_2)_{10}\text{O}(\text{CH}_2)_3\text{NCO}$, PPDI (Akzo, duPont), 2,4-TDI (Bayer), TDI(80:20) (BASF, Dow, Olin, Rhone-Poulenc, Enichem), MDI (BASF, Bayer, Dow, ICI, Enichem, Mitsui, Toatsu), PMDI (BASF, Bayer, Dow, ICI, Enichem, Mitsui, Toatsu), NDI (Bayer), TODI (Nippon-Soda), and the like.</p> | <p>Page 44, lines 7-31 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>Blends of diisocyanates and triisocyanates that are useful in the present invention are disclosed in U.S. Pat. No. 5,925,595, to Seitz et al. A preferred diisocyanate is meta-tetramethylenexylylene diisocyanate (TMXDI), and a preferred triisocyanate is N,N',N''-tris(6-isocyanatohexyl)-nitrodotricarbonic triamide (CAS N. 67635-83-0; available as Desmodur N3,200 from Bayer Corporation, Pittsburgh, Pa.). It is more preferred that the polyisocyanates include both a diisocyanate and a triisocyanate.</p> | <p>Col. 25, line 66 to Col. 26, line 7 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047) which is identical to</p> <p>Page 44, line 32 to page 45, line 5 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>It is believed that the ratio between the number of functional groups</p> | <p>Col. 26, lines 8-15 in U.S. App. Ser. No. 10/115,765</p> |

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| <p>supplied by the diisocyanate and by the triisocyanate has an effect upon the composition of the polyurea shell and, thus, can be used as a controllable parameter for obtaining a desired release rate. When TMXDI and N,N',N''-tris(6-isocyanatohexyl)-nitrodotricarbonic triamide are used as the diisocyanate and triisocyanate, respectively, a preferred ratio is 1:1.</p> | <p>(issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 45, lines 6-11 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>Polyamines (i.e., polyfunctional amines) that are useful in the present method include any polyamine that is capable of reacting with polyisocyanates to form polyurea. Suitable amines include, but are not limited to, diethylene triamine, triethylene tetramine, tetraethylene pentamine, iminobispropylamines, amine epoxy adducts, alkylldiamines from ethylene diamine to hexamethylene diamine, trimethylolpropane tris[poly(propylene glycol)amine terminated]ether (available as Jeffamine T-403, CAS No. 39423-51-3) from Texaco Corp. or Aldrich), all diamines and triamines produced by Texaco Corp. and marketed under the trade name of Jeffamine, piperazine, isophorone diamine, bis-(4-aminocyclohexyl)methane, 1,2-, 1,3-, and 1,4-cyclohexane diamine, 1,2-propane diamine, N,N,N-tris-(2-aminoethyl)-amine, poly(ethyleneimine)s, N-(2-aminoethyl)-piperazine, N,N'-bis-(3-aminopropyl)-ethylenediamine, N,N'-bis-(2-aminoethyl)-1,3-propylenediamine, N,N'-bis-(3-aminopropyl)-1,3-propylenediamine, N,N,N'-tri-(2-aminoethyl)-ethylene diamine,</p> | <p>Col. 26, lines 16-34 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 45, lines 12-27 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>It is preferred that the one or more polyamines that are used in the method include at least one triamine and/or at least one tetramine. In fact, it is</p> | <p>Col. 26, lines 35-44 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> |

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| <p>more preferred that two or more polyamines be used and that they be selected from diamines, triamines and tetramines. It is even more preferred that both a triamine and a tetramine are included. Preferred triamines include trimethylolpropane tris[poly(propylene glycol)amine terminated]ether (available as Jeffamine T-403), and diethylene triamine, and preferred tetramines include triethylenetetramine (TETA).</p> | <p>which is identical to</p> <p>Page 45, line 28 to page 46, line 3 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>When a blend of a triamine and a tetramine is added to the reaction, it is preferred that the ratio of the number of functional groups supplied by the triamine relative to the number of functional groups supplied by the tetramine that is used is between about 100:0 to 0:100. As used herein, this ratio may be referred to as the ratio between the of equivalents of triamine:tetramine. A ratio of equivalents of triamine:tetramine of between about 90:10 and 10:90 is more preferred, yet more preferred is a ratio of between about 80:20 and 20:80, even more preferred is a ratio of between about 60:40 and 40:60, and yet more preferred is a ratio of about 50:50.</p> | <p>Col. 26, lines 45-56 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 46, line 4-13 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>It has been found that the release rate of an agricultural active in the core of a microparticle having a polyurea shell, can be modulated by varying the ratio of the equivalents of a triamine such as Jeffamine T-403 and the equivalents of a tetramine such as triethylene tetramine. Accordingly, the parameter of the equivalents ratio of triamine to tetramine that is used in the interfacial polymerization reaction is one of the parameters that can be used to obtain a pre-selected controlled release rate of the active.</p> | <p>Col. 26, lines 57-65 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 46, lines 14-21 in PCT/US02/10551, published as WO 2002/082901</p> |

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| <p>When the total amount of polyisocyanates and the total amount of polyamines that are contacted in the present method are considered, it is preferred that the ratio of the total equivalents of polyisocyanates to the total equivalents of polyamines is between about 4:1 and 1:4, more preferred is a ratio of 2:1 to 1:2, and yet more preferred is a ratio of about 1:1.</p> | <p>Col. 26, line 66 to Col. 27, line 5 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 46, lines 22-27 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>It is believed that the temperature at which the polymerization reaction takes place is a factor in obtaining a fully-formed and intact shell, without pores or other significant irregularities. Accordingly, it is preferred that the polymerization reaction is carried out at a temperature of between about 25°C and about 90°C, and more preferred that the temperature be between about 40°C and 75°C.</p> | <p>Col. 27, lines 6-12 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 46, line 28 to page 47, line 2 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>When the novel microcapsules are formed, the thickness of the shell wall can be controlled by varying the amount of the combined polyisocyanates and polyamines that are used, relative to the total amount of the liquid organic phase. The higher the level of polyisocyanates and polyamines with respect to the amount of the liquid organic phase, the thicker the polyurea shell wall that will be formed. In this specification the shell wall thickness is expressed in terms of the weight ratio of polyurea to core material. The weight ratio of the polyurea shell to the core can be controlled as described above, and desirably falls between about 5:100 and about 50:100. It is more preferred that the shell:core weight ratio is between about 10:100 and about 40:100, yet more preferred about 15:100 to about 30:100. However,</p> | <p>Col. 27, lines 13-31 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 47, lines 3-18 in PCT/US02/10551, published as WO 2002/082901</p> |

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| <p>since the thickness of the shell wall has an effect on the rate of release of an agricultural active from the core of the microcapsule when it is exposed to natural environmental conditions, shell wall thickness is a variable that can be controlled to provide a pre-selected release rate profile.</p> | |
| <p>The terms "natural environmental conditions", as used herein, are to be understood to mean the weather conditions that a microcapsule of the present invention will be exposed to when it is applied to a plant, a seed, or to soil, in a conventional soil-based growing environment. Such conditions include normal ambient rainfall, soil moisture, sunshine, temperature, biological activity, and the like.</p> | <p>Col. 27, lines 32-38 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 47, lines 19-24 in PCT/US02/10551, published as WO 2002/082901</p> |
| <p>When it is said that the agricultural active is released from the microcapsule at a "pre-selected controlled rate", the terms "pre-selected controlled rate" refer to a pre-selected release profile of the active from the microcapsules, as can be represented by a plot of the cumulative amount of the active that has been released as a function of the time of exposure. One method of obtaining a microcapsule having a pre-selected controlled release rate is to determine the release rate of the active from the microcapsule under standardized test conditions (such as are described in detail in the Examples below) and then correlating the release profile obtained under standard conditions with the release profile of the active under normal environmental conditions. One of skill in the art of controlled released pesticides would understand that after this correlation is made several times, the release</p> | <p>Col. 27, lines 39-56 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 47, line 25 to page 48, line 7 in PCT/US02/10551, published as WO 2002/082901</p> |

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| <p>profile determined according to the standardized test methods can be used to predict the release rate under normal environmental conditions.</p> | |
| <p>The controlled release forms of the present invention can be of any geometrical shape, but spherical microcapsules are preferred. A particularly useful form of the novel microcapsule includes a polyurea shell enclosing a core which comprises silthiopham, where the microcapsule has an average size of from about 2μ to about 8 μ where the weight ratio of the shell to the core is from about 15:100 to about 30:100, and where the amount of silthiopham in the core is from about 30% to about 60%, by weight.</p> | <p>Col. 27, lines 57-65 in U.S. App. Ser. No. 10/115,765 (issued as U.S. Pat. No. 6,992,047)</p> <p>which is identical to</p> <p>Page 48, lines 8-15 in PCT/US02/10551, published as WO 2002/082901</p> |

Inasmuch as there are **no** differences between the disclosure that describes work unequivocally declared by the four inventors to be the work of the four inventors in U.S. Pat. No. 6,992,047 and the disclosures of WO 2002/082901, the disclosures are identical. Only a confounding twist of illogic could possibly suggest that the disclosures are somehow separable. Thus, the disclosures relied upon by the Office in WO 2002/082901 is necessarily the work of the four inventors of the present case and is thus not "by others" as required by 35 U.S.C. §102(a). In view thereof, these disclosures are not prior art against the pending claims and all rejections of claims 1, 24, 25, 32, 55, and 56 and the dependent claims based thereon should be withdrawn.

CONCLUSION

Applicants do not believe that a fee is required for the filing of this response, as it is being submitted within the three month shortened statutory period for reply. Should applicants be incorrect, the Commissioner is hereby authorized to charge the necessary fee to Deposit Account No. 19-1345.

Respectfully submitted,

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